भारतीय मानक
Indian Standard

IS 5189 : 2022

कोल्ड पॉलीमराइज़्ड कच्चा स्टाइरीन-बूटीडाइएन रबड़ — विशिष्टि

(दूसरा पुनरीक्षण)

Cold Polymerized Raw Styrene-Butydiene Rubber — Specification

(Second Revision)

ICS 83.060

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February 2022 **Price Group 3**

Rubber and Rubber Products Sectional Committee, PCD 13

FORWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Rubber and Rubber Products Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

This Standard was first published in 1969 and subsequently revised in 1985. In first revision, additional requirement for relative density was included. In the absence of an acceptable test method for the estimation of gel content, it is envisaged to include the same in due course of time when accurate method is made available. For compounding test recipe based on high abrasion furnace (HAF) carbon black has been prescribed with consequential changes in the requirements of compounded rubber.

The first revision prescribed two types of non-oil-extended raw styrene butadiene rubbers (SBR) manufactured by cold polymerization using emulsion technique normally below 10 °C. Type 1 prescribed corresponds to the commercially known SBR 1500; this number was allotted by the International Institute of Synthetic Rubber Producers' Inc, USA. Type 2 prescribed corresponding to non-oil-extended SBR manufactured by cold polymerization, commercially known as SBR 1502 which was allotted by the same Institute.

For type 1, the following staining type stabilizers were generally used:

a) An acetone-diphenylamine reaction product; and

b) A mixture of alkylated diphenylamines.

NOTE — Styrenated phenol at 1.0 to 1.8 percent by mass may also be used.

For Type 2, the following non-staining type stabilizers were generally used:

a) Styrenated phenols; and

b) An alkylated aryl phosphite.

Globally three non-oil-extended raw styrene butadiene rubbers (SBR) that is, raw elastomer manufactured by cold polymerization using emulsion technique (SBR 1500, SBR 1502 and SBR 1509), which could contain staining or non-staining stabilizers/antioxidants. Therefore, in this second revision, a new type SBR 1509 has been included. The packaging requirements have also been modified to cover present packaging practices. Scope of the standard has been updated including the term 'cold polymerization'. Amendment no 1 has also been considered while revising this standard.

With the changed technologies, the following staining and non-staining type stabilizers are prevalent in industry.

Staining type stabilizers typically used are acetone-diphenylamine reaction product, or mixture of alkylated diphenylamine or mixture of p-Phenylenediamine derivatives (Alkyl-aryl-p-Phenylenediamines). Alternatively, non-staining type stabilizers are also used. Typical non-staining stabilizers are styrenated phenols, or alkylated arylphosphite (tri-nonylphenyl phosphite-TNPP).

The composition of the Committee responsible for formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

COLD POLYMERIZED RAW STYRENE-BUTYDIENE RUBBER — SPECIFICATION

(Second Revision)

1 SCOPE

This standard prescribes the requirements and the methods of sampling and test for non-oil-extended, non-pigmented, raw styrene-butadiene rubbers (SBR), obtained by copolymerization of styrene and butadiene at low temperatures, typically termed as 'cold polymerization'.

2 REFERENCES

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreement based on standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No./Other Publications	*Title*
3400 (Part 1) : 2012/ ISO 37 : 2011	Methods of test for vulcanized rubber: Part 1 Tensile stress-strain properties (*third revision*)
3660 (Part 7) : 2013/ ISO 289-1 : 2005	Methods of test for natural rubber: Part 7 Determination of mooney viscosity [NR : 8] (*third revision*)
3708 (Part 9) : 2018/ ISO 247 : 2006	Methods of test for natural rubber latex Part 9 Determination of total ash (*third revision*)
4511 (Part 5) : 2005/ ISO 7781 : 2001	Method of test for styrene-butadiene rubber (SBR), latices: Part 5 Determination of soap and organic-acid content (*second revision*)
4518 (Part 1) : 1967	Methods of test for styrene-butadiene rubbers (SBR): Part 1 Determination of volatile matter, total ash, organic acid, soap, antioxidants, bound styrene and mooney viscosity
5599 : 1999	Rubber — Raw, natural and synthetic — Methods for sampling and sample preparation (*first revision*)
14788 : 2018/ ISO 2322 : 2014	Styrene-butadiene rubber (SBR) — Emulsion-and solution-polymerized types — Evaluation procedures (*first revision*)
ISO 248-1 : 2011	Rubber, raw — Determination of volatile-matter content — Part 1 Hot-mill method and oven method
ISO 248-2 : 2019	Rubber, raw — Determination of volatile-matter content — Part 2: Thermogravimetric methods using an automatic analyser with an infrared drying unit
ISO 2453 : 2020	Rubber, raw styrene-butadiene, emulsion-polymerized — Determination of bound styrene content — Refractive index method

3 TYPES

3.1 This standard covers the followings three types of copolymers of styrene and butadiene.

a) *SBR 1500* — Non-oil-extended, non-pigmented, emulsified with rosin acid or blend of rosin acid and fatty acid soap, coagulated with sulphuric acid and coagulation aid.

b) *SBR 1502* — Non-oil-extended, non-pigmented, emulsified with blend of rosin acid and fatty acid soap, coagulated with sulphuric acid and coagulation aid.

c) *SBR 1509* — Non-oil-extended, non-pigmented, emulsified with blend of rosin acid and fatty acid soap, coagulated with sulphuric acid and coagulation aid.

4 REQUIREMENTS

4.1 Description

The materials shall be free from any visual anomalies (contamination/foreign matter) and manufactured by cold polymerization process using rosin acid or mixed rosin acid and fatty acid soap as emulsifier, sodium chloride and sulphuric acid or acid as coagulant (coagulation aid can be used for better coagulation efficiency) and non-staining or staining type stabilizer.

4.2 The material shall also comply with the requirements prescribed in Table 1 when tested according to the methods prescribed in column 9 of Table 1.

5 PAKING AND MARKING

5.1 Packing

Individual bales shall be first wrapped with PE/EVA film and such wrapped bales shall be further packed in appropriate packing as per following process:

a) Individual bales shall be first wrapped in suitable dispersible PE/EVA film having:
   1) Film thickness shall be greater than 50 microns;
   2) maximum melting point as 115 °C; and
   3) Relative density as 0.915 – 0.925.
b) Wrapped bales can then be further packed in either of following individual/bulk packing for appropriate handling and transportation:
   1) HDPE laminated paper bags; and
   2) Bulk packaging crates (wooden/plastic/metal).

5.2 Marking

The packaging material (HDPE laminated paper bags/Bulk packaging crates) shall be marked with the following information:

a) type of rubber;
b) name of the manufacturer and trade name, if nay;
c) net mass of the material;
d) batch number/lot number;
e) year of manufacture; and
f) safety instruction, if any.

5.3 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and *the Rules and Regulations* framed thereunder, and the products may be marked with the Standard Mark.

6 SAMPLING AND CRITERIA FOR CONFORMITY

The scale of sampling and criteria for conformity of a consignment of the rubber to this standard shall be as prescribed in IS 5599.

Table 1 Requirements for Cold Polymerized Raw Styrene-Butadiene Rubber

(*Clause* 4.2)

Sl No.	Characteristics	Requirement						Method of Test, Refer to
		SBR 1500		SBR 1509		SBR 1502		
		Min	*Max*	*Min*	*Max*	*Min*	*Max*	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	Emulsifier type	Rosin Acid/Mixed Rosin Acid-Fatty Soap		Mixed Rosin Acid-Fatty soap		Mixed Rosin Acid-Fatty soap		–
ii)	Volatile matter, percent by weight	–	0.75	–	0.75	–	0.75	SBR: 1 of IS 4518 (Part 1)/ISO 248-1/ISO 248-2
iii)	Total ash, percent by weight	–	0.75	–	0.75	–	0.75	SBR: 3 of IS 4518 (Part 1)/IS 3708 (Part 9)
iv)	Organic acid, percent by weight	4.75	7.25	4.75	7.25	4.75	7.25	SBR: 4 of IS 4518 (Part 1)/IS 4511 (Part 5)
v)	Soap, percent by weight	–	0.50	–	0.5	–	0.50	SBR: 5 of IS 4518 (Part 1)/IS 4511 (Part 5)
vi)	Bound styrene, percent by weight	22.5	24.5	22.5	24.5	22.5	24.5	SBR: 7 of IS 4518 (Part 1)/ISO 2453
vii)	ETA solvent extract, percent by weight	6.0	10.0	6.0	10.0	6.0	10.0	SBR: 9 of IS 4518 (Part 1)
viii)	Mooney viscosity-(massed), ML1 + 4 at 100 °C (MU)	44.0	58	30.0	40.0	44.0	58	SBR: 8 of IS 4518 (Part 1)/IS 3660 (Part 7)
ix)	Relative density	0.93	0.95	0.93	0.95	0.93	0.95	Annex A

NOTE — In case of dispute, the alternate method of test as given in col 9 of Table 1 shall be the referee test method.

ANNEX A

[*Clause* 4.2, *Table* 1, *Sl No.* (ix)]

DETERMINATION OF RELATIVE DENSITY

A-1 RELATIVE DENSITY

A-1.1 Pycnometer Method

Determine the relative density using the pycnometer with alcohol in place of water to eliminate the error due to air bubbles. Take measurements at a temperature between 24.5 and 25.5 °C, unless the coefficient of expansion of the rubber product is known, in that case make the determination at any convenient temperature and correct to 25 °C.

A-1.1.1 *Calculation*

$$\text{Relative density at 25 °C} = \frac{0.9971 \times M_1 \times D}{M_1 - (M_2 - M_3)}$$

where

M_1 = mass of specimen;
M_2 = mass of pycnometer filled with specimen and alcohol;
M_3 = mass of pycnometer filled with alcohol; and
D = density of alcohol at 25 °C.

A-1.2 Density Balance Method by Immersion

Determine the mass of a specimen in air. It is then immersed in a liquid, its apparent mass upon immersion is determined, and its specific gravity (relative density) calculated.

A-1.2.1 *Calculation*

$$\text{Relative density at 23 °C} = \frac{(\mathrm{a} \times \mathrm{d})}{(\mathrm{a} + \mathrm{w} - \mathrm{b})}$$

where

a = apparent mass of specimen, without wire or sinker, in air;
b = apparent mass of specimen (and of sinker, if used) completely immersed in liquid;
w = apparent mass of totally immersed sinker (if used); and
d = density of the immersion liquid at 23 °C.

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Rubber and Rubber Products Sectional Committee, PCD 13

Organization	*Representative(s)*
The Rubber Board, Kottayam	Dr James Jacob (***Chairman***) Dr Siby Varghese (*Alternate*)
Dow Corning India Pvt Ltd	Shri Subhranshu Gupta
Export Inspection Council of India	Shri K. J. Srivastav
Flame Retardants Association of India, Gurugram	Shri P. V. Murali Mohan
Grp Limited, Mumbai	Shri Kalyan Das
Hasetri, Rajasthan	Shri Saikat Das Gupta
Hindustan Latex Lifecare Limited	Dr A. G. Shankaran
Indian Rubber Mfrs Research Association (IMRA), Mumbai	Dr K. Raj Kumar Dr Bharat Kapgate (*Alternate*)
Ka Pre Vulcanized, Tamilnadu	Shri Praveen Mathew (Director)
LPG equipment research centre, Bangaluru	Shri A. Krishna Kutty Shri K. K. Thakur (*Alternate*)
Ministry of Defence (DGQA), New Delhi	Shri S. K. Saxena Shri V. K. Chhabra (*Alternate*)
All India Rubber Industries Association, Mumbai	Shri Srikanth Krishnamurthy Shri Chinmoy Ray (*Alternate*)
Association of Planters Kerala	Shri Santosh Kumar Shri Philip C. Jacob (*Alternate*)
Automotive Tyres Manufacturers Association (ATMA), New Delhi	Shri Rajiv Budhraja Shri Vinay Vijayvargia (*Alternate*)
Block Rubber Processor’s Association of India	Shri Rajiv Tharian Shri Ronny Joseph (*Alternate*)
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Research, Designs & Standards Organization, Lucknow	Shri Mnjesh Kumar Shri Ravi Prakash (*Alternate*)
Shri Sati Rubber Industries, Jaipur	Shri Vijay Kumar Agarwal Shri Sudhir Agarwal (*Alternate*)

Organization	*Representative(s)*
Voluntary Organization in Interest of Consumer Education (VOICE), New Delhi	Shri M. A. U. Khan Shri H. Wadhwa (*Alternate*)
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In Personal Capacity	Dr Sunny Sebastian
In Personal capacity	Dr Ranjit Mathhan
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Member Secretary

Vijay Kumar Gupta
Scientist 'D' (PCD), BIS

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